

Quiz Friday, May 4th

Fibre Optics and Total Reflection

Demonstration:

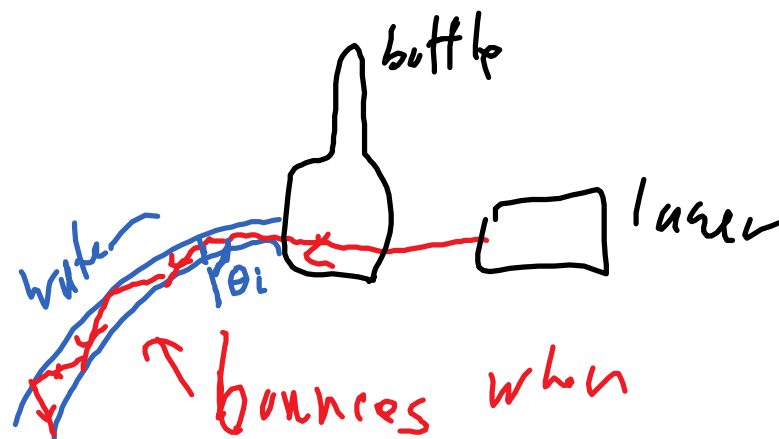
Laser shining into a pop bottle with a hole.

As the water pours out of the bottle, the light bounces down the water spout. It bounces because it hits the surface past the critical angle, θ_c .



VID_20180
430_1020...

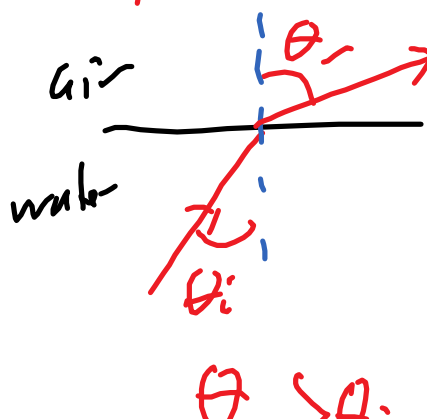
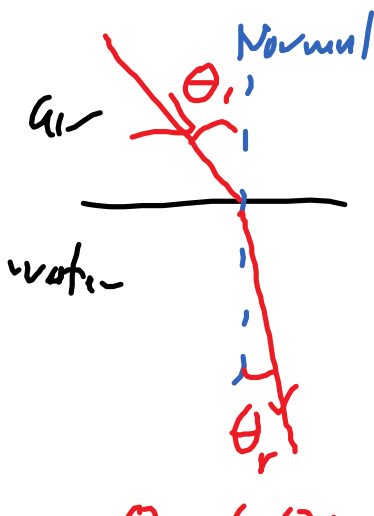
(thanks
Emily)



$$\theta_i > \theta_c$$

incident
angle

critical
angle



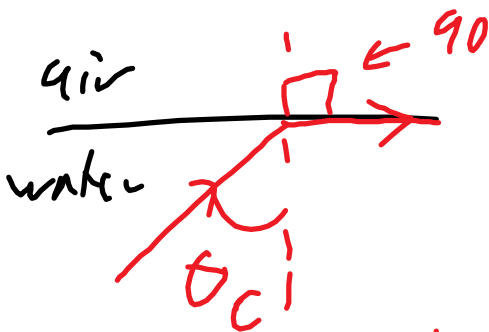
$$\theta_r < \theta_i$$

$$\theta_r > \theta_i$$

$$n_i \sin \theta_i = n_r \sin \theta_r \quad n_i \sin \theta_i = n_r \sin \theta_r$$

$$n_i = \text{air} = 1.0003 \quad n_r = \text{water} = 1.33$$

$$n_r = \text{water} = 1.33 \quad n_i = \text{air} = 1.0003$$

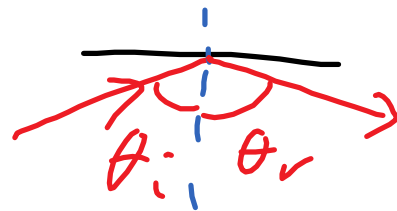


Critical angle, θ_c

$$n_i \sin \theta_c = n_r \sin 90^\circ$$

$$n_i \sin \theta_c = n_r$$

$$\theta_c = \sin^{-1}\left(\frac{n_r}{n_i}\right)$$



$$\theta_i = \theta_r$$

Passes
critical
angle

- total
internal
reflection

eg. In the lab, you shined light through water at various angles.

Given $n_{\text{water}} = 1.33$ and $n_{\text{air}} = 1.0003$

$$n = c/v \quad n_i \sin \theta_i = n_r \sin \theta_r \quad \theta_c = \sin^{-1}(n_r/n_i)$$

a) If the light is incident at 33.2° on water, what angle does it go through the water? Draw the ray.

b) If the light is incident from water on air at 33.2° , what angle does it go out into the air? Draw the ray.

c) what is the critical angle between water and air?

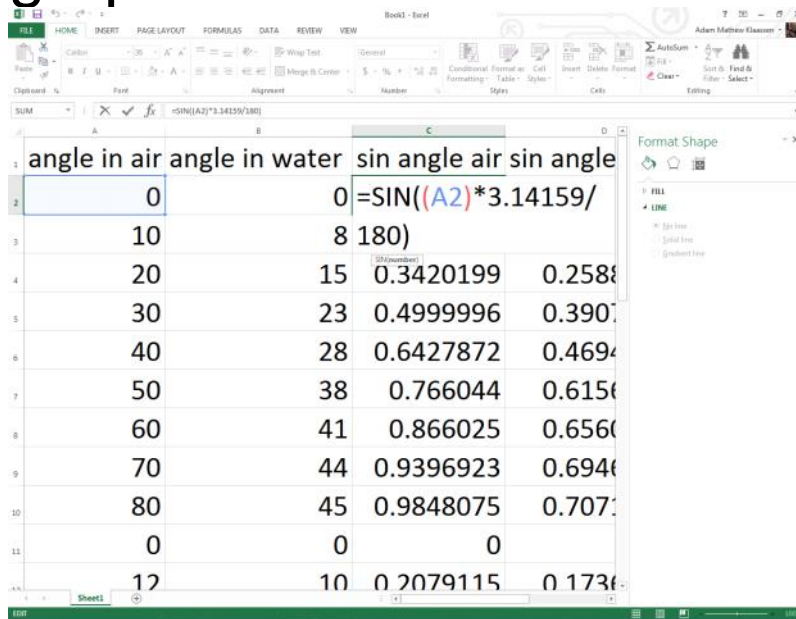
d) what is the speed of light in water?

p355-361 Q5-8, CR1.1-1.4, CR2.1-2.4

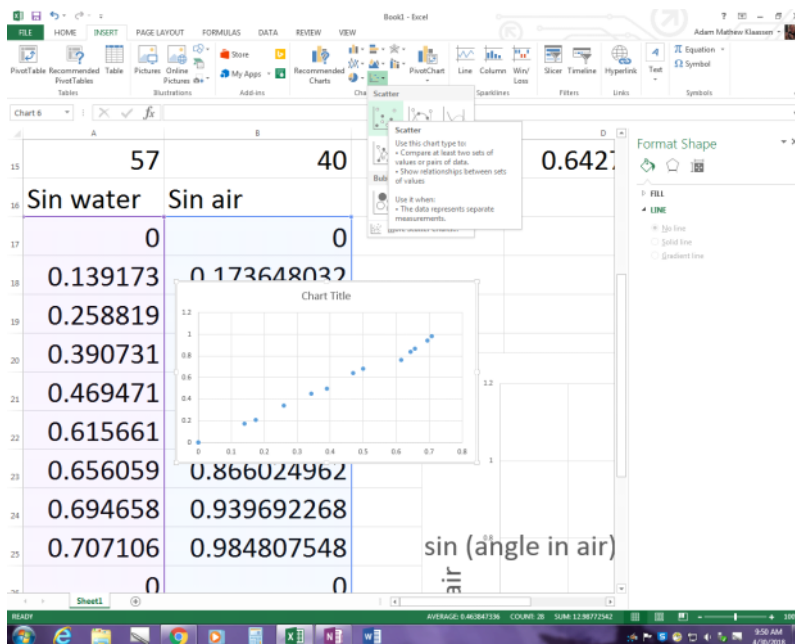
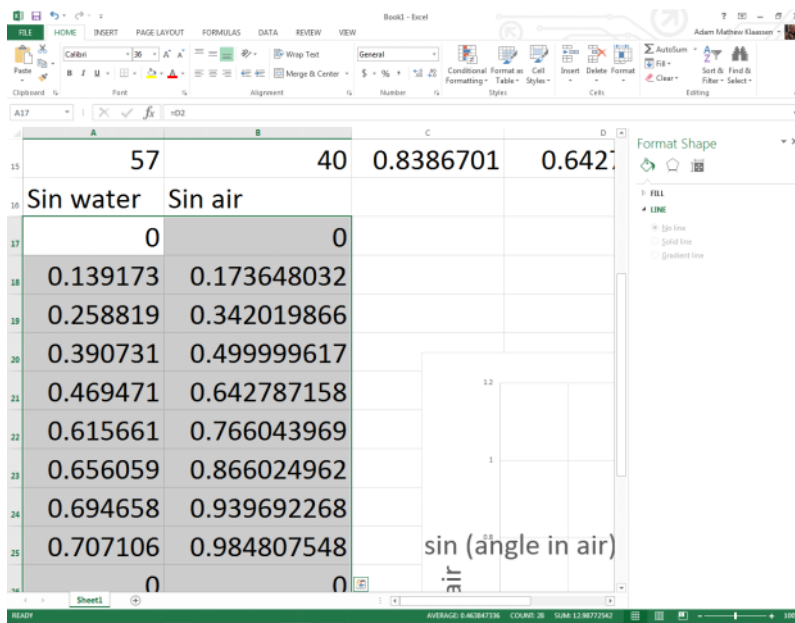
p365 Q23 block is 3.5 cm by 6.0cm

and light enters at the middle of the smaller side.

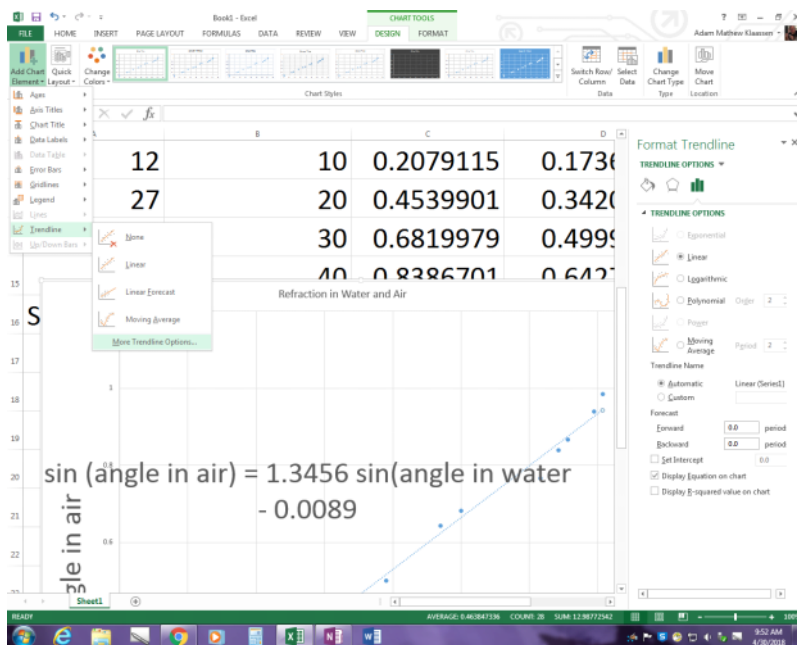
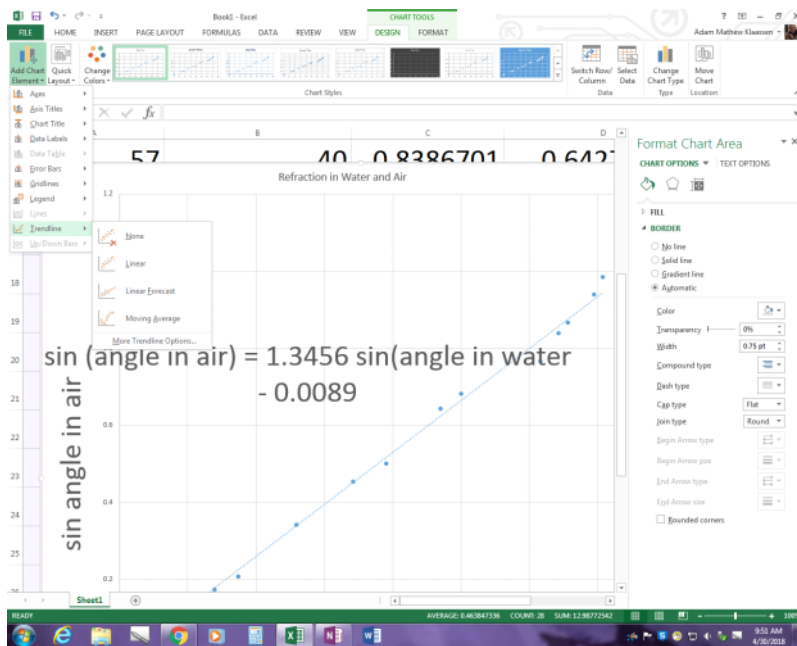
Lab you can use a spreadsheet to graph the data:

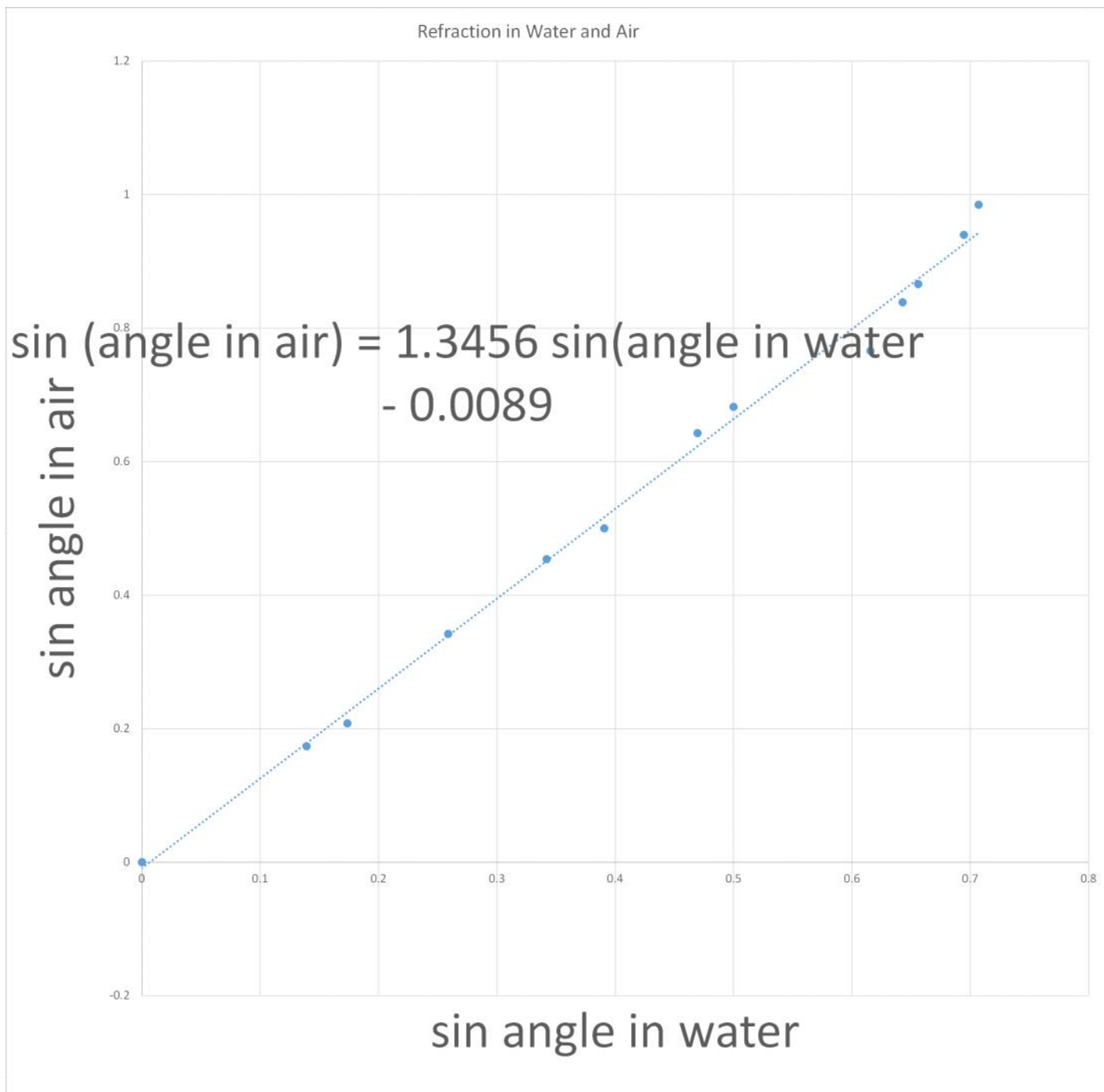


angle in air	angle in water	sin angle air	sin angle
0	0	0	0
10	15	0.3420199	0.2588
20	23	0.4999996	0.3907
30	28	0.6427872	0.4694
40	38	0.766044	0.6156
50	41	0.866025	0.6560
60	44	0.9396923	0.6940
70	45	0.9848075	0.7071
80	0	0	0
0	10	0.2079115	0.1736



Be sure to add trendline and display trendline on graph





percent error = $(\text{slope} - 1.33) / 1.33 \times 100\%$
eg = $(1.3456 - 1.33) / 1.33 = 0.0117 = 1.2\%$

analysis do the questions in the labbook
conclusion with % error
sources of uncertainty
e-mail the lab report to

aklaassen@vsb.bc.ca
in pdf format